NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

HIGHLIGHTED ARTICLES

Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico

The poleward migration of the location of tropical cyclone maximum intensity

Invasion of Asian tiger shrimp, *Penaeus monodon* Fabricius, 1798, in the western north Atlantic and Gulf of Mexico

Indicators for assessing the ecological dynamics and sustainability of southern Florida's coral reef and coastal fisheries

Interactive effects of mosquito control insecticide toxicity, hypoxia, and increased carbon dioxide on larval and juvenile eastern oysters and hard clams

ADDITIONAL ARTICLES

Atmospheric sciences and related research: current systems, emerging technology, and future needs

Forecaster use and evaluation of real-time 3DVAR analyses during severe thunderstorm and tornado warning operations in the Hazardous Weather Testbed

Correspondence between scale morphometrics and scale and otolith chemistry for interpreting juvenile salmon life histories

Novel *in situ* tagging technique for fishes demonstrated on invasive lionfish

Boundary influences on HAB phytoplankton ecology in a stratification-enhanced upwelling shadow

Real time PCR assays for detection of Brucella spp. and the identification of genotype ST27 in bottlenose dolphins (*Tursiops truncatus*)



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

Waterbirds as indicators of ecosystem health in the coastal marine habitats of Southern Florida: selection and justification for a suite of indicator species and conceptual ecological models

Domoic acid epileptic disease

Effects of overlapping generations on linkage disequilibrium estimates of effective population size

Technical note: a corrected formulation of the multilayer model (MLM) for inferring gaseous dry deposition to vegetated surfaces

Seasonal and interannual variability in the spatial overlap between forage fishes and the large medusa Chrysaora fuscescens in the northern California Current region

Permeability of dihydro- and cysteine-brevetoxin metabolites across a Caco-2 cell monolayer

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

Technical and mapping support for Washington state marine spatial planning

Best management practices for marine cage culture operations in the U.S. Caribbean



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

HIGHLIGHTED ARTICLES

Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico
Endangered Species Research
P. E. Rosel and **L. A. Wilcox (NMFS/SEFSC)**

- The small, resident population of Bryde's whales in the northern Gulf of Mexico appears to be genetically distinct from all other Bryde's whales worldwide; it is genetically divergent from other members of the Bryde's whale complex as are the two recognized subspecies.
- The genetic divergence suggests a unique evolutionary trajectory worthy of its own taxonomic standing, and that if the population were lost it would not be replenished by Bryde's whales from adjacent waters.

Bryde's whale, *Balaenoptera edeni*, is the only year-round resident baleen whale species in the northern Gulf of Mexico (GOM) and has a current population abundance estimate of 33 (CV 1.07). We characterized genetic diversity and phylogenetic relationships of these whales to other members of the Bryde's whale complex. For 21 Bryde's whale samples collected in the GOM and 2 from the western North Atlantic, we analyzed DNA sequence data from 3 mitochondrial DNA (mtDNA) and 9 nuclear genes, and examined 42 nuclear microsatellite loci. MtDNA diversity was extremely low: only 2 haplotypes were found in the first 375bp of the control region and no variability in *cytb* or *cox1* genes was seen. Twenty-five microsatellite loci were monomorphic, 16 had 2 or 3 alleles and one had 4 alleles. Most nuclear genes exhibited shared alleles across species from the family Balaenopteridae. Phylogenetic reconstruction using the control region and all published Bryde's whale sequences revealed GOM Bryde's whale haplotypes are evolutionarily distinct from other members of the Bryde's whale complex examined to date. Within the first 375bp of the control region, we found 25-26 fixed differences between GOM haplotypes and those from sei whales and the two recognized Bryde's whale



subspecies. The divergence of GOM whales suggests a unique evolutionary trajectory worthy of its own taxonomic standing. The small population size and markedly low genetic diversity raise conservation concern for this unique group of whales.
Accepted: 3 April 2014

The poleward migration of the location of tropical cyclone maximum intensity
Nature
J. Kossin (NESDIS/NCDC), K. Emanuel, and **G. Vecchi (OAR/GFDL)**

- The latitude where tropical cyclones achieve their maximum intensity is migrating away from the deep tropics at a rate of about 1° latitude per decade.
- This is consistent with the observed range of tropical expansion rates, which is generally understood to be partly driven by anthropogenic factors.
- Continued poleward migration of tropical cyclone activity would have potentially profound consequences to life and property.

Temporally inconsistent and potentially unreliable global historical data hinder detection of trends in tropical cyclone activity. This limits the confident evaluation of proposed linkages between observed trends in tropical cyclones and in the environment. Here we mitigate this difficulty by focusing on a metric that is comparatively insensitive to past data uncertainty, and we identify a pronounced poleward migration in the average latitude where tropical cyclones have achieved their lifetime-maximum intensity (LMI) over the past 30 years. The poleward trends are evident in the global historical data in both the Northern and Southern Hemispheres with rates of 53 and 62 km per decade, respectively, and are statistically significant. When considered together, the trends in each hemisphere depict a global-average migration of tropical cyclone activity away from the tropics at a rate of about 1° latitude per decade, which lies within the range of estimates of the observed expansion of the tropics over this same period.



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

The global migration remains evident and statistically significant under a formal data homogenisation procedure and is unlikely to be a data artefact. The migration away from the tropics is apparently linked to marked changes in the mean meridional structure of environmental vertical wind shear and potential intensity and can be plausibly linked to tropical expansion, which is generally thought to have anthropogenic contributions.
Expected Publication Date: May 2014

Invasion of Asian tiger shrimp, Penaeus monodon *Fabricius, 1798, in the western north Atlantic and Gulf of Mexico*
Aquatic Invasions
P.L. Fuller, D.M. Knott, P.R. Kingsley-Smith, **J.A. Morris, C.A. Buckel**, M.E. Hunter, and L.D. Hartman **(NOAA/NCCOS)**

- Asian tiger shrimp have reappeared in the South Atlantic Bight and, for the first time ever, in the Gulf of Mexico, and ecological and economic impacts may occur.
- Coastal managers and community planners can use these findings to make environmentally responsible decisions about marine invasive species.

After going unreported in the northwestern Atlantic Ocean for 18 years (1988 to 2006), the Asian tiger shrimp, *Penaeus monodon*, has recently reappeared in the South Atlantic Bight and, for the first time ever, in the Gulf of Mexico. Potential vectors and sources of this recent invader include: 1) discharged ballast water from its native range in Asia or other areas where it has become established; 2) transport of larvae from established non-native populations in the Caribbean or South America via ocean currents; or 3) escape and subsequent migration from active aquaculture facilities in the western Atlantic. This paper documents recent collections of *P. monodon* from the South Atlantic Bight and the Gulf of Mexico, reporting demographic and preliminary phylogenetic information for specimens collected between North Carolina and



Texas from 2006 through 2012. The increased number of reports in 2011 and 2012, ranging from 102 mm to 298 mm total length, indicates that an adult population is present in densities sufficient for breeding, which is indicative of incipient establishment. Based on these reports of *P. monodon*, its successful invasion elsewhere, and its life history, the Authors believe that this species will become common in the South Atlantic Bight and Gulf of Mexico in less than 10 years. *P. monodon* is an aggressive predator in its native range and, if established, may prey on native shrimps, crabs, and bivalves. The impacts of an established *P. monodon* population are potentially widespread (e.g., alterations in local commercial fisheries, direct and indirect pressures on native shrimp, crab and bivalve populations, and subsequent impacts on the populations of other predators of those organisms) and should be considered by resource managers. The impacts of *P. monodon* on native fauna and the source(s) or vector(s) of the invasion, however, remain unknown at this time.
Published Online: 7 March 2014
http://www.aquaticinvasions.net/2014/AI_2014_Fuller_etal.pdf

Indicators for assessing the ecological dynamics and sustainability of southern Florida's coral reef and coastal fisheries
Ecological Indicators
J. S. Ault, S. G. Smith, **J. Browder (NMFS/SEFSC),** W. Nuttle, E. C. Franklin, J. Luo, **G. T. DiNardo (NMFS/PIFSC)**, and **J. A. Bohnsack (NMFS/SEFSC)**

- The study compares two different population indicators: catch per unit of fishing effort (CPUE), and average length in the exploited life stage of a population; either indicator could be used to estimate fishing mortality rates (F).
- Data requirements are much less stringent for estimating F from the average length indicator than CPUE, making it more practical for data-poor situations common to



tropical marine fisheries.

Commercial and recreational fisheries target hundreds of fish and shellfish species across the seascape of southern Florida including inshore coastal bays, the flats of barrier islands, coral reefs and offshore pelagic waters. The ecological dynamics and economic sustainability of these valuable fishery resources are key conservation concerns. This study examined two ecological indicators of fishing impacts on exploited populations: (1) the more traditional metric catch per unit of fishing effort (CPUE); and (2) the non-traditional metric average length in the exploited life stage of a population. We show that both indicators were closely related to stock productivity, and that either indicator could be used to estimate fishing mortality rates (F). Using indicator-based estimates of F within a population dynamic modeling framework enabled an evaluation of fishing impacts on sustainability at both the species and fish community levels, an important step towards ecosystem-based fisheries assessment and management. A comparison of these approaches applied to the assessment of southern Florida coral reef fisheries suggested that fishing has fundamentally altered the ecological structure of the fish community by depleting the biomass of higher-trophic level carnivores to the extent that the stocks are unsustainable.

Accepted: 7 April 2014

Interactive effects of mosquito control insecticide toxicity, hypoxia, and increased carbon dioxide on larval and juvenile eastern oysters and hard Clams

Archives of Environmental Contamination and Toxicology

R.N. Garcia, **K.W. Chung, P.B. Key,** L.E. Burnett, L.D. Coen, and **M.E. DeLorenzo (NOS/NCCOS)**

- The authors determined that mosquito insecticides affected larval and juvenile life stages of clams and oysters by reducing swimming activity, decreasing growth, and increasing



mortality.

- This study also demonstrated that low pH caused by elevated CO2 and low oxygen conditions caused significant effects on larval clam survival, which were exacerbated by insecticide exposure.
- This paper is of great value in understanding the effects of mosquito control insecticides on larval and juvenile life stages of ecologically and commercially important bivalve species, *Mercenaria mercenaria* and *Crassostrea virginica*.
- These data will assist environmental resource agencies in managing the use of mosquito control insecticides near sensitive coastal habitats.

Mosquito control insecticide use in the coastal zone coincides with the habitat and mariculture operations of commercially and ecologically important shellfish species. Few data are available regarding insecticide toxicity to shellfish early life stages, and potential interactions with abiotic stressors such as low oxygen and elevated CO2 (low pH) are less understood. Toxicity was assessed at 4 days and 21 days for larval and juvenile stages of the Eastern oyster, *Crassostrea virginica*, and the hard clam *Mercenaria mercenaria*, using two pyrethroids (resmethrin and permethrin), an organophosphate (naled), and a juvenile growth hormone mimic (methoprene). Acute toxicity (4 d LC50) values ranged from 1.59 to >10 mg/L. Overall, clams were more susceptible to mosquito control insecticides than oysters. Naled was the most toxic compound in oyster larvae, while resmethrin was the most toxic compound in clam larvae. Mortality for both species generally increased with chronic insecticide exposure (21 d LC50 values ranged from 0.60 to 9.49 mg/L). Insecticide exposure also caused sublethal effects, including decreased swimming activity after 4 d in larval oysters (4 d EC50 values of 0.60 to 2.33 mg/L) and decreased growth (shell area and weight) in juvenile clams and oysters after 21 d (detected at concentrations ranging from 0.625 to 10 mg/L). Hypoxia, hypercapnia and a combination of hypoxia and hypercapnia caused mortality in larval clams and increased resmethrin toxicity.



These data will benefit both shellfish mariculture operations and environmental resource agencies as they manage the use of mosquito control insecticides near coastal ecosystems.
Published Online: 16 February 2014

ADDITIONAL ARTICLES

Atmospheric sciences and related research: current systems, emerging technology, and future needs
Bulletin of the AMS
H. B. Bluestein, R. M. Rauber, **D. W. Burgess**, B. Albrecht, S. M. Ellis, Y. P. Richardson, **D. P. Jorgensen**, S. J. Frasier, P. Chilson, R. D. Palmer, S. E. Yuter, W. Lee, D. C. Dowell, P. L. Smith, P. M. Markowski, K.Friedrich, and T. M. Weckwerth (**OAR/ARL**)

- This article describes future radar needs for the science community
- It highlights the emerging radar technologies that will be most helpful in answering key scientific questions.
- It also highlights the fact that radar developers need to think far ahead (~50 years). What is useful now can quickly become old technology.

To assist the National Science Foundation in meeting the needs of the community of scientists by providing them with the instrumentation and platforms necessary to conduct their research successfully, a meeting was held in late Nov. 2012 with the purpose of defining the problems of the next generation that will require radar technologies and determining the suite of radars best suited to help solve these problems. The research community recommended polarimetric radars. S-band and Bragg-scattering radars, airborne radars, diverse radar platforms at several wavelengths, VHF profiling systems, radars in data sparse areas, deployable networks of radars, phased-array radar technology, better software tools for radar display and analysis, availability



of radar instrumentation for the research community, educational support, and an increase computer resources.
Published: Online release 2 April 2014

Forecaster use and evaluation of real-time 3DVAR analyses during severe thunderstorm and tornado warning operations in the Hazardous Weather Testbed
Weather and Forecasting
K. M. Calhoun, T. M. Smith, D. M. Kingfield, **J. Gao** and **D. J. Stensrud (OAR/NSSL)**

- The eventual goal of this real-time 3DVAR system is to help meteorologists better track severe weather events and eventually provide better warning information to the public, ultimately saving lives and reducing property damage.

A weather-adaptive three-dimensional data assimilation (3DVAR) system was included in the NOAA Hazardous Weather Testbed as a first step towards introducing Warn-on-Forecast initiatives into operations. NWS forecasters were asked to incorporate the data in conjunction with single-radar and multi-sensor products in the Advanced Weather Interactive Processing System (AWIPS) as part of their warning-decision process for real-time events across the United States. Forecasters found the updraft, vertical vorticity, and storm-top divergence products the most useful for storm interrogation and quickly visualizing storm trends, often using these tools to increase the confidence in a warning decision and/or issue the warning slightly earlier. Blending data from multiple radars was extremely useful to forecasters rather than having to analyze multiple radars separately. The largest hurdle for realtime use of 3DVAR or similar data assimilation products by forecasters is the data latency, as even 4-6 minutes reduces the utility of the products when new radar scans are available.
Early Online: 27 March 2014



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

Correspondence between scale morphometrics and scale and otolith chemistry for interpreting juvenile salmon life histories

Transactions of the American Fisheries Society

L. A. Campbell, **D. L. Bottom (NMFS/NWFSC)**, E. C. Volk, and I. A. Fleming

- The results of this study suggest that salmon life history interpretations made from scale morphometrics alone may be inaccurate and should be validated using another method.
- Scale chemistry offers some promise for salmon life history interpretation.
- While scale chemistry is less sensitive than otolith chemistry, it may be useful when fish cannot be sacrificed for otoliths.

Fine-scale resolution of habitat transitions have been proposed and used to estimate the movement of juvenile fish from freshwater, estuary and ocean environments by way of scale checks and circuli spacing. We tested the accuracy of using such scale morphometric criteria and scale chemistry for identifying the transition of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) from freshwater to marine portions of the Columbia River estuary by comparing scale morphometric classification, scale chemistry and otolith chemistry. Nearly half of all fish collected in the saline portion of the estuary and approximately one quarter in the freshwater portion exhibited morphometric patterns (i.e., scale checks and intermediate growth) often associated with periods of estuary rearing. Depending upon the criteria used to define scale checks, otolith chemical results indicated that 33-53% of fish would have been misclassified as estuary residents based solely on their scale patterns. Moreover, many individuals who had resided in Sr-rich estuary water did not form a visible check (37%) on their scales to coincide with estuary entry. We estimated from otolith chemistry that these fish had either entered at or near the size at which scale formation occurs (35-42mm) or had recently migrated to the saline portion of the estuary (<30 d) before new scale material could be formed and calcified. Scale chemistry alone was a good indicator of entrance into the saline portion of the estuary.



Regardless of fish size, scale chemistry responded to the strontium-enriched salt water, and explained 86% of the variation.
Expected Publication Date: Summer 2014

Novel in situ *tagging technique for fishes demonstrated on invasive lionfish*
Methods in Ecology and Evolution
J.L. Akins, **J.A. Morris, Jr. (NOAA/NCCOS)**, and S.J. Green

- This work describes a novel tagging technique for reef fish.
- This technique of applying external streamer and dart tags *in situ* can also be used to investigate invasive lionfish ecology.
- Therefore, coastal managers and community planners can use this information to make environmentally responsible management decisions about marine invasive species.

Information on fish movement and growth is primarily obtained through the marking and tracking of individuals with external tags, which are usually affixed to anesthetized individuals at the surface. However, the quantity and quality of data obtained by this method is often limited by small sample sizes owing to the time associated with the tagging process, high rates of tagging-related mortality, and displacement of tagged individuals from the initial capture location. To address these issues, the authors describe a novel technique for applying external streamer and dart tags *in situ*, which uses SCUBA divers to capture and tag individual fish on the sea floor without the use of anesthetic. The authors demonstrate the application of this method for Indo-Pacific lionfish (*Pterois volitans/P. miles*), species which are particularly vulnerable to barotrauma when transported to and handled at the surface. To test this method, the authors tagged 161 individuals inhabiting 26 coral reef locations in the Bahamas over a period of three years. Results indicate that this method resulted in no instances of barotrauma, reduced handling and recovery time, and minimal post-tagging release displacement compared



with conventional *ex situ* tag application. Opportunistic re-sighting and re-capture of tagged individuals reveals that lionfish exhibit highly variable site fidelity, movement patterns, and growth rates on invaded coral reef habitats. In total 24% of lionfish were re-sighted between 29-188 days after tagging. Of these, 90% were located at the site of capture, while the remaining individuals were re-sighted between 200m -1.1km from initial site of capture over 29 days later. *In situ* growth rates ranged between 0.1 - 0.6 mm/day. While individuals tagged with streamer tags posted slower growth rates with increasing size, as expected, there was no relationship between growth rate and fish size for individuals marked with dart tags, potentially because of large effects of tag presence on the activities of small bodied lionfish (i.e. <150mm), where the tag was up to 7.6% of the lionfish's mass. This study offers a novel *in situ* tagging technique that can be used to provide critical information on fish site fidelity, movement patterns, and growth in cases where *ex situ* tagging is not feasible.
Expected Publication Date: April 2014

Boundary influences on HAB phytoplankton ecology in a stratification-enhanced upwelling shadow
Deep Sea Research Part II: Topical Studies in Oceanography
J.P. Ryan, M.A. McManus, R.M. Kudela, M. Lara Artigas, J.G. Bellingham, F.P. Chavez, G. Doucette, **D. Foley (NMFS/SWFSC/ERD)**, M. Godin, J.B.J. Harvey, R. Marin III, M. Messié, C. Mikulski, T. Pennington, F. Py, K. Rajan, I. Shulman, Z. Wang, and Y. Zhang

- This work analyzes ocean observing and modeling data to examine boundary influences driving phytoplankton (harmful algal blooms species) ecology in Monterey Bay, CA, USA
- Biological transitions are closely related to environmental changes (i.e., oceanic circulation, wind forcing, influx of different water types, nearshore water stratification).



- Results showed that small-scale spatial patterns in the toxicity of Pseudo-nitzschia populations were related to the coupling of resuspended sediments from the bottom boundary layer to the surface mixed layer.

Coastal marine ecosystems are profoundly influenced by processes that originate from their boundaries. These include fluid boundaries—with the atmosphere, oceanic boundary currents and terrestrial aquatic systems, as well as solid boundaries—with the seafloor and coast. Phytoplankton populations transfer complexly interacting boundary influences into the biosphere. In this contribution, the Authors apply data from an ocean observing and modeling system to examine boundary influences driving phytoplankton ecology in Monterey Bay, CA, USA. The study was focused on species that may cause harmful algal blooms (HABs). During September–October 2010, autonomous molecular analytical devices were moored at two locations characterized by different degrees of stratification and exposure to upwelling dynamics. The time-series revealed multiple transitions in local HAB phytoplankton communities, involving diatoms (*Pseudo-nitzschia* spp.), dinoflagellates (*Alexandrium catenella*), and raphidophytes (*Heterosigma akashiwo*). Observational and model results showed that the biological transitions were closely related to environmental changes that resulted from a variety of boundary processes—responses of oceanic circulation to wind forcing, influxes of different water types that originated outside the bay, and emergence of strongly stratified nearshore water into the greater bay. Boundary processes were further implicated at patch scales. High-resolution mapping and sampling of a phytoplankton-enriched patch were conducted in a Lagrangian framework using autonomous underwater vehicles. These highly resolved measurements showed that small-scale spatial patterns in the toxicity of Pseudo-nitzschia populations were related to the coupling of resuspended sediments from the bottom boundary layer to the surface mixed layer.

Published: March 2014



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

Real time PCR assays for detection of Brucella spp. and the identification of genotype ST27 in bottlenose dolphins (Tursiops truncatus)
Journal of Microbiological Methods
Q. Wu, W. E. McFee, T. Goldstein, R. V. Tiller, and **L. Schwacke (NOS/NCCOS)**

- Authors developed real-time PCR assays developed for detection of bacteria *Brucella* spp. and identification of *Brucella* genotype ST27 in marine mammals.
- All positive reactions detected using this assay for ST27, a species with zoonotic potential, were found in fetus/neonates of bottlenose dolphins.

Rapid detection of *Brucella* spp. in marine mammals is challenging. Microbiologic culture is used for definitive diagnosis of brucellosis, but is time consuming, has low sensitivity and can be hazardous to laboratory personnel. Serological methods can aid in diagnosis, but may not differentiate prior exposure versus current active infection and may cross-react with unrelated gram-negative bacteria. This study reports a real-time PCR assay for the detection of *Brucella* spp. and application to screen clinical samples from bottlenose dolphins stranded along the coast of South Carolina, USA. The assay was found to be 100% sensitive for the *Brucella* strains tested, and the limit of detection was 0.27 fg of genomic DNA from *B. ceti* B1/94 per PCR volume. No amplification was detected for the non-*Brucella* pathogens tested. *Brucella* DNA was detected in 31% (55/178) of clinical samples tested. These studies indicate that the real-time PCR assay is highly sensitive and specific for the detection of *Brucella* spp. in bottlenose dolphins. We also developed a second real-time PCR assay for rapid identification of *Brucella* ST27, a genotype that is associated with human zoonotic infection. Positive results were obtained for *Brucella* strains which had been identified as ST27 by multilocus sequence typing. No amplification was found for other *Brucella* strains included in this study. ST27 was identified in 33% (18/54) of *Brucella* spp. DNA-positive clinical samples. It should be noted that a positive real-time PCR result only indicates presence of the *Brucella* DNA; this does not



necessarily indicate an active infection. To the authors' knowledge, this is the first report on the use of a real-time PCR assay for identification of *Brucella* genotype ST27 in marine mammals. Early Release Online: http://www.sciencedirect.com/science/article/pii/S0167701214000736

Waterbirds as indicators of ecosystem health in the coastal marine habitats of Southern Florida: selection and justification for a suite of indicator species and conceptual ecological models

Ecological Indicators

J. C. Ogden, J. D. Baldwin, O. L. Bass, **J. A. Browder (NMFS/SEFSC),** M. I. Cook, P. C. Frederick; P. E. Frezza, R. A. Galvez, A. B. Hodgson, K. D. Meyer, L. D. Oberhofer, A. F. Paul, P. J. Fletcher, S. M. Davis, and J. J. Lorenz

- As part of the NOAA Marine and Estuarine Goal Setting for South Florida authors proposed a suite of birds as indicators of ecosystem health, generated integrated conceptual ecosystems models, and found that waterbird presence reflects habitat integrity and productivity.
- This research contributes to the science behind South Florida Ecosystem Restoration and the Comprehensive Everglades Restoration Projects.

As part of the NOAA Marine and Estuarine Goal Setting for South Florida (MARES) project, authors propose a suite of birds grouped more for their habitat (coastal wetlands and nearshore waters) and food habits (aquatic prey such as fish, shrimp, crabs, and mollusks) than by their taxonomy as indicators of ecosystem health to help protect and restore the coastal waters of south Florida. In Paper 1 (Selection and justification for a suite of indicator species), species were selected on the basis of a review of their life history for characteristics that might make them particularly vulnerable to the types of anthropogenic pressures the coastal marine environment of south Florida is experiencing. In Paper 2 (Conceptual ecological models),



integrated conceptual ecosystem models (ICEM) show how waterbirds fit into, and define the ecological characteristics of, three sub-regions of south Florida: the Florida Keys and Dry Tortugas, the Southwest Florida Shelf, the Southeast Florida Shelf, and the total marine ecosystem that couples the MARES models to Comprehensive Everglades Restoration Project conceptual models for Biscayne Bay, Florida Bay, and the Caloosahatchee estuary.
Expected Publication Date: May 2014

Domoic acid epileptic disease
Marine Drugs
J. Ramsdell, F. Gulland **(NOS/NCCOS)**

- Domoic acid epileptic disease is characterized by spontaneous recurrent seizures weeks to months after domoic acid poisoning and atypical behaviors in animal subjects, notably conspecific aggression.
- Precise understanding of the disease state draws on investigations of environmental exposures of humans, sea lions and experimental studies conducted at NCCOS laboratories.

Domoic acid epileptic disease is characterized by spontaneous recurrent seizures weeks to months after domoic acid exposure. The potential for this disease was first recognized in a human case study of temporal lobe epilepsy after the 1987 amnesic shellfish-poisoning event in Quebec, and was characterized as a chronic epileptic syndrome in California sea lions through investigation of a series of domoic acid poisoning cases between 1998 and 2006. The sea lion study provided a breadth of insight into clinical presentations, unusual behaviors, brain pathology, and epidemiology. A rat model that replicates key observations of the chronic epileptic syndrome in sea lions has been applied to identify the progression of the epileptic disease state, its relationship to behavioral manifestations, and to define the neural systems



involved in these behavioral disorders. Here, we present the concept of domoic acid epileptic disease as a delayed manifestation of domoic acid poisoning and review the state of knowledge for this disease state in affected humans and sea lions. We discuss causative mechanisms and neural underpinnings of disease maturation revealed by the rat model to present the concept for olfactory origin of an epileptic disease; triggered in dendodendritic synapases of the olfactory bulb and maturing in the olfactory cortex. We conclude with updated information on populations at risk, medical diagnosis, treatment, and prognosis.
Expected Publication Date: 6 March 2014

Effects of overlapping generations on linkage disequilibrium estimates of effective population size
Genetics
R. S. Waples (NMFS/NWFSC), T. Antao, and G. Luikart

- Effective population size (Ne) is one of the most important parameters in evolutionary biology but is very challenging to estimate, especially for species with overlapping generations. Genetic methods developed to estimate Ne in species with discrete generations are routinely applied to age-structured species, producing results that are difficult to interpret.
- The authors evaluated how age structure influences estimates of Ne and developed quantitative methods to produce low bias estimates.
- Results from this study will facilitate interpretation of rapidly-accumulating genetic estimates of effective size in species with overlapping generations.

Use of single-sample genetic methods to estimate effective population size has skyrocketed in recent years. Although the underlying models assume discrete generations, they are widely applied to age-structured species. The authors simulated genetic data for 21 iteroparous animal and plant species to evaluate two untested hypotheses regarding performance of the single-



sample method based on linkage-disequilibrium (LD): 1) estimates based on single-cohort samples reflect the effective number of breeders in one reproductive cycle (Nb); and 2) mixed-age samples reflect the effective size per generation (Ne). They calculated true Ne and Nb using the model species' vital rates and verified these with individual-based simulations. They show that single-cohort samples should be equally influenced by Nb and Ne and confirm this with simulated results. The authors provide a quantitative bias correction for raw Nb^ based on the ratio Nb/Ne, which can be estimated from two or three simple life history traits. Bias-adjusted estimates were within 5% of true Nb for all 21 study species and proved robust when challenged with new data. Mixed-age adult samples produced downwardly-biased estimates in all species, which we attribute to a two-locus Wahlund effect (mixture LD) caused by combining parents from different cohorts in a single sample. Results from this study will facilitate interpretation of rapidly-accumulating genetic estimates in terms of both Ne (which influences long-term evolutionary processes) and Nb (which is more important for understanding eco-evolutionary dynamics and mating systems).
Expected Publication Date: Summer 2014

Technical note: a corrected formulation of the multilayer model (MLM) for inferring gaseous dry deposition to vegetated surfaces
Atmospheric Environment
R. Saylor, G. Wolfe, **T. Meyers**, and B. Hicks **(OAR/ARL)**

- Revision of the NOAA Multilayer Model used to estimate athmospheric dry deposition. Using the revised formulation may reduce U. S. EPA estimates of total oxidized nitrogen over the U. S. by 10-20% as compared to estimates derived from the original formulation.
- Historical estimates of reactive nitrogen deposition over the U. S. should be recalculated with the new formulation.



- New measurements of reactive nitrogen surface-atmosphere exchange are needed to evaluate deposition parameterizations more rigorously and better constrain total nitrogen deposition over the U.S.

The article describes a revision to the NOAA Multilayer Model (MLM) which is used by the U. S. Environmental Protection Agency to estimate atmospheric dry deposition of several trace species over the U. S. It suggests a revision to the formulation of MLM which makes the model more physically and mathematically consistent with the prevailing conceptual understanding of the dry deposition of gaseous species to vegetated surfaces. The suggested change to MLM primarily affects the estimated deposition of gaseous nitric acid, reducing its mid-day deposition values by as much as 38%, and potentially reducing estimated deposition of total oxidized nitrogen by 10-20% as compared to estimates derived from the original formulation of MLM. The article recommends that historical estimates of reactive nitrogen deposition over the U. S. should be recalculated with the new formulation and that new measurements of reactive nitrogen surface-atmosphere exchange are needed to better constrain total nitrogen deposition.
Expected Publication Date: Late April 2014

Seasonal and interannual variability in the spatial overlap between forage fishes and the large medusa Chrysaora fuscescens in the northern California Current region
Marine Ecology Progress Series
R. Brodeur (NMFS/NWFSC), C. Barcelo, K.L. Robinson, E.A. Daly, and J. J. Ruzicka

- Studies correlation of abundance and spatial overlap of jellyfish populations with small pelagics (sardines and anchovies) and herrings to determine which species have potential for higher impact.
- Findings discover that jellyfish can have spatial overlap with forage fishes in the California Current.



- Abundance of jellyfish inversely related to forage fish abundance Model results suggest negative impacts of jellyfish on forage fishes.

As in many regions of the world, the shelf waters of the western United States have experienced large increases and high interannual variability in jellyfish populations. The northern California Current (NCC) is a productive upwelling zone that is home to large populations of medusae particularly during some years. Seasonal trawl surveys in the NCC since 1999 have documented a substantial biomass of jellyfish consisting primarily of one species, the sea nettle (Chrysaora fuscescens) with abundances generally peaking in late summer. Trophic overlap can be high in the NCC with planktivorous species such as Pacific sardines and herring that consume copepods and euphausiid eggs. In this study, we examine the spatial overlap and co-occurrence of C. fuscescens and Pacific herring (Clupea pallasi), northern anchovy (Engraulis mordax) and Pacific sardine (Sardinops sagax) in the NCC using spatial analyses tools to determine the species that have the potential to be most affected by high jellyfish biomass and the geographic areas in which these interactions are likely to occur. Significant spatial overlap of these jellyfish with these pelagic fishes occurred during certain months and years, although the results were highly variable. There was an overall negative relationship between the abundance of Chrysaora and the catch of the three forage fishes for both June and September. End-to-end food web models show that jellyfish have a greater potential to affect production of pelagic forage fishes than the reverse.

Accepted: 3 April 2014

Permeability of dihydro- and cysteine-brevetoxin metabolites across a Caco-2 cell monolayer

Harmful Algae

Je´roˆme Henri, **T. A. Leighfield,** R. Lanceleur, A. Huguet , **J.S. Ramsdell,** and V. Fessard **(NOAA/NOS)**



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

- Brevetoxin B2, an abundant shellfish metabolite of brevetoxin found in Gulf of Mexico oysters, does not readily pass through an intestinal barrier rendering it unlikely to cause neurotoxic shellfish poisoning.
- The results, which are being further confirmed in an animal model, indicate this common long lasting brevetoxin metabolite in shellfish can serve as a marker for exposure to red tides, but may not represent the health risk for shellfish consumers using currently applied testing methods.

Brevetoxin B is a highly reactive molecule, due in part to an a,b-unsaturated aldehyde group at the terminal side chain, leading to metabolism by reduction, oxidation and conjugation. These reactions have little effect to reduce intrinsic activity at the voltage-gated sodium channel or during toxicity testing by either enzyme-linked immunosorbent assay or mouse bioassay. Here we investigate the potential for intestinal absorption of the two most abundant brevetoxins present in Gulf of Mexico oysters using human Caco-2 cell monolayers, a widely utilized in vitro test to predict oral bioavailability of drugs and their metabolites. We found that both dihydrobrevetoxin B and cysteine brevetoxin B were rapidly taken up by the Caco-2 monolayer. However, only dihydrobrevetoxin B passes through the monolayer to reach the basal compartment. Dihydrobrevetoxin B has a moderate apparent permeability coefficient of 1.6 _ 10 _6 cm/s at 500 ng/mL and nearly 50% of the toxin passes from the apical to basal compartment in 24 h. The inability of the cysteine brevetoxin B to pass through an intestinal epithelial barrier suggests that this bioactive brevetoxin metabolite that persists in shellfish may not contribute to neurotoxic shellfish poisoning.

Published: February 2014

Article link: http://www.sciencedirect.com/science/article/pii/S1568988313001832



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

Technical and mapping support for Washington state marine spatial planning

C. Menza, **T. Battista** and **D. Dorfman (NOS/NCCOS)**

- This report develops a spatial prioritization process to identify seafloor, seabird, and deep-sea coral and sponge datasets needed to support marine spatial planning by the state of Washington
- While robust seabird, sponge, and coral distribution datasets exist at coarse spatial resolutions, additional mapping efforts are needed to assess distributions at fine spatial scales in pelagic waters and across seasons.

This report identifies and evaluates seafloor, seabird, deep-sea coral and sponge datasets needed to support marine spatial planning by the state of Washington. The physical and ecological targets of this report were chosen by the Washington Department of Ecology, with input from the State Ocean Caucus, and represent priority data sets needed for marine spatial planning along Washington's outer coast. The report outlines the key participants, next steps, timelines, and expected outcomes of a structured prioritization process for seafloor mapping needs. Additionally, a geospatial data viewer of existing seafloor mapping information has been constructed to allow planners at the Washington Department of Natural Resources and their associates to visualize data and allow users to easily evaluate the extent, type, and quality of known data sources. The report's evaluation of seabird and deep sea coral and sponge datasets includes inventories of existing data sets, a summary of how similar datasets have been used by other marine spatial planners, and identification of data gaps. It provides an overview of existing knowledge of seabird, deep sea corals, sponge spatial distributions, and is intended to improve access to existing data and prioritize future data collection efforts to support marine spatial planning.

Expected Publication Date: January 2014



NOAA SCIENTIFIC PUBLICATIONS REPORT
APRIL 29, 2014

Best management practices for marine cage culture operations in the U.S. Caribbean
Gulf and Caribbean Fisheries Institute Special Publication Series
C. S. Price (NOS/NCCOS), and **J. Beck-Stimpert (NMFS)**

- Best Management Practices (BMPs) are a tool for implementing responsible marine cage culture, which safeguards and maintains healthy ocean ecosystems.
- Coastal managers and community planners can use this information to make environmentally responsible decisions about the economic opportunities that aquaculture offers.
- Federal, state and local regulatory agencies can consider these practices as they develop and implement permitting and monitoring processes for the Caribbean offshore aquaculture industry.

In 2010, the Puerto Rico Department of Natural and Environmental Resources and the National Oceanic and Atmospheric Administration (NOAA) convened a workshop in conjunction with the 63rd Gulf and Caribbean Fisheries Institute meeting in San Juan, Puerto Rico to begin developing BMPs for marine cage culture operations in the U.S. Caribbean, with emphasis on reducing impacts to coral reef habitats. The workshop participants included managers from federal, state, and territory regulatory agencies, researchers, university professors, representatives from environmental organizations, and the aquaculture industry. The participants included experts in the regulatory processes, coral reef ecology, marine habitat monitoring and assessment, water quality and benthic modeling, and marine aquaculture. The goal of the workshop was to produce an initial list of key elements to include in the BMPs that would reduce potential impacts to coral ecosystems from marine finfish aquaculture (Appendix IV, Table 1) and identify management tools that reduce or eliminate environmental impacts. The outcomes of this workshop formed the basis upon which these BMPs were further developed by teams of experts working together to craft each chapter. Once the chapters were completed and compiled, over 20 expert reviewers, most of whom participated in the workshop,



provided input to improve and refine the final BMP report. These BMPs represent guidelines, developed collaboratively by a diverse stakeholder group that can be voluntarily implemented at marine cage culture operations in U.S. territorial waters of the Caribbean.
Expected Publication Date: April 2014